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RUPTURE OF THE HEALTHY ŒSOPHAGUS.

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The recent occurrence of a case of rupture of the œsophagus, in the practice of Dr. George O. Allen, of Boston, has led to as thorough a research as possible into the literature of the subject. The results of this investigation have seemed such as to render it desirable to call renewed attention to this lesion, of which our knowledge has been enlarged by the detailed report of this case, upon the consideration of which the present article is based.

It is to be stated at the outset, that by the term rupture of the œsophagus is meant a complete, defined solution of continuity, extending through the walls of this tube, and occurring during life.

This, of course, may be produced in various ways. The cases are sufficiently numerous where, in the progress of an abscess in the vicinity of the gullet, perforation of the latter eventually takes place. In this series may also be included the advance of cavities from the air passages and from the bronchial glands. Somewhat analogous are the instances of an aneurism of the aorta, or of its primary branches, which in time reaches the œsophagus, and the invervening tissues give way. The perforations caused by sharp and pointed foreign bodies, by the rude introduction of tubes, bougies, and the like, are also left out of consideration; so, too, the sloughings produced by caustics, which may be accidentally or intentionally swallowed, and those resulting from the progress of morbid growths. Only that form of rupture is to be considered which takes place in persons previously healthy, especially in those in whom there is no evidence of any local disease of the œsophagus or of

the surrounding parts. This possibility remains, and, as the evidence to be presented shows,there exists the certainty that a previously healthy œsophagus may be suddenly ruptured by muscular action.

Such a proposition is by no means a novel one, and has been made much more often than it has been proven. Limited as the literature of this subject is, it evidently contains numerous errors of observation and conclusion which almost warrant the scant attention, and more frequent omission, which are to be noticed in most of the text-books, whether old or recent, clinical or anatomical. The descriptions of the causes, symptoms, and their sequence, the nature of the lesion and its immediate effects, may be regarded as traditions, to be believed in, perhaps, because it is worth no one's while to contradict them; and worth no one's while, because the matter has never been thought of.

The following case may therefore be regarded as one of exceptional interest and importance: of interest, from the rarity of its occurrence, its clinical obscurity, and the long duration of life in the presence of so serious an injury; of importance, from its tolerably uncomplicated character, the thoroughness of its description, and the unquestioned nature of the lesion.

Dr. Allen writes as follows:—

"Mr. ——, 31 years of age, was engaged in mercantile pursuits. His general condition was that of debility, due to the long continued and excessive use and abuse of alcoholic stimulants. A year previous to his last illness he had an attack of delirium tremens while in Washington, and, upon his partial recovery and return home, was under my charge for a while, affected with obstinate gastritis, but from which he eventually recovered. In December, 1875, he suffered from another attack of gastritis, though the threatening delirium was averted by the free use of stimulants. He recovered from this attack in about a week. During this sickness, and the previous one, a persistent and distressing symptom was the vomiting of blood, which in variable proportions formed a part of every discharge from the stomach. For years he was in the habit of cutting his food into small pieces, and he ate slowly, but never complained of pain or difficulty in swallowing.

"I was called to see him about 9 P. M., January 26, 1876. Before seeing him, was told that, while at supper, about three hours previous, he suddenly became partially strangled by some article of food lodging 'somewhere in his throat.' His countenance did not become blue, nor was there any difficulty of respiration.

"Every resource of domestic surgery was employed to afford him relief, and after an hour of great discomfort and intense anxiety, he succeeded, by a concentration of his entire muscular energy, in ejecting the obstructing fragment. This proved to be a piece of hard, tough, gristly meat, nearly circular in shape, about an inch in length, and rather more than half an inch in diameter. It came from his mouth with the noise and force as if 'propelled from a pop-gun;' he sank back upon the sofa exhausted, and almost immediately ejected a moderate quantity of clotted and liquid blood. His attendant then noticed a 'swelling' at the angle of the lower jaw, on the left side, followed by a corresponding swelling on the right; these were soon united by a swollen isthmus across the upper part of the trachea

and the larynx. He was now undressed and put to bed, in a completely exhausted condition, complaining of thirst but not of pain. Fluids were easily swallowed, and without discomfort. Cold water applications were made about his throat, but, the prostration continuing, and the swelling rapidly increasing, I was called to see him.

"I found him lying on his back, with a pale face and anxious countenance; the eyes were closed, the lids twitching and trembling. The respiration was nearly natural, though slightly hurried; pulse 90, and small; skin moist. He complained of no pain, but had slight tenderness on pressure on the left side of the trachea, just over the clavicle. He was somewhat restless, and there was slight nausea. He had vomited but once, this an hour after the food was expelled, and the vomit contained no blood. There was drowsiness, but inability to sleep. The swelling was then extending upon both sides of the face, both cheeks being considerably puffed out. I learned that in his efforts at expelling the meat, the lungs were fully inflated, and then, the muscles being tense, violent expulsive efforts were made, during which he became 'red in the face.' These efforts were not suggestive of vomiting, nor was there any complaint of nausea. There was an occasional slightly bloody expectoration. A few minutes before the meat was ejected, the patient removed his collar and loosened his shirt, on account of a feeling of constriction. The swelling of the face came on very rapidly after the food was raised. Pain in the left chest was then complained of, but there was no evidence of any sudden tearing of the tissues in this region.

"A quarter of a grain of sulphate of morphia was given him, and a sinapism applied over his stomach.

"*Jan.* 27. Was called during the night. The swelling had increased; both cheeks were puffed out; the whole neck and upper part of the chest were also swollen, pitting on pressure, the pits slowly disappearing upon the removal of the fingers.

"During the day the swelling continued to increase, extending down the arms to the hands and fingers. The swollen face was hard and tense, with a dark, erysipelatous look and feel. He complained of occasional sharp, migratory pains in the right side, and in the upper part of the back. Pulse 100, and full; surface of the body dry and hot; tongue moist, and coated with a thin, white fur. There is constant thirst. The contents of the stomach are frequently ejected, and blood is occasionally vomited. He swallows without difficulty and without pain. There is tenderness on pressure in the neck, and upon both sides of the trachea. There is no cough, but a constant expectoration of thick, tenacious mucus, sometimes mixed with blood. Bowels have not been moved; urinates naturally.

"Bismuth and morphia were ordered, with ice; small quantities of beef-tea and milk, and cooling lotions externally.

"28*th*. The patient was seen several times during the day and night. His condition this morning is not materially changed, except that he suffers less pain, and has less irritability of the stomach. He slept at intervals, for a few minutes at a time, during the night. Pulse 100, and small; skin dry; thirst continuous; bowels have been moved; urinates without difficulty; is quite weak. The emphysematous nature of the affection is fully developed; the whole subcutaneous cellular tissue of the body appears to be undergoing the process of inflation. The face, eyelids, neck, the upper part of the chest in front, and the entire back, are swollen; the scrotum is enormously distended, and the inflation extends

to the middle of the thighs. Everywhere, upon slight pressure, the sharp, crackling sound, indicating the presence of air, is heard and felt. On account of the sudden onset and rapid progress of the emphysema, the relations of the parts have been so changed that the precise nature and locality of the lesion which permits the admission of air into the subcutaneous cellular tissue have not been determined. Notwithstanding the great extent of this inflation, the action of the lungs is but little impeded, and respiration is performed with but little difficulty, though with a slightly accelerated rapidity. Orthopnœa was never present.

"29*th*. Condition about the same as yesterday. The swelling does not increase, and has even diminished on the face and arms; the scrotum also is less distended than yesterday. The nausea has nearly disappeared, though alcoholic stimulants induce it. He is still quite weak, and is nervous and restless. Hoffmann's anodyne is more efficient in relieving pain and in quieting restlessness than any other article that has been used.

"With the assistance of Dr Joseph Stedman, a more thorough examination of the patient was attempted, with the hope of fixing the locality of the lesion, but without satisfactory result. A general supporting treatment is pursued. In the evening symptoms of delirium tremens manifested themselves.

"30*th*, 31*st*, *Feb*. 1. The patient passed through an ordinary attack of delirium tremens, falling into a deep, stertorous sleep during the night of the 1st. During these three days the emphysema has remained without marked change, and the patient has complained of no pain except in the stomach. He swallowed without difficulty whatever was given him in the way of medicine or nourishment. His bowels have been opened daily. The respiration for the most part easy, and only slightly hurried. There is a profuse mucous expectoration, occasionally tinged with blood. Pulse to-day 112. There is considerable exhaustion, but stimulants and nourishment can be taken and retained.

"2*d*. Patient is weaker, was restless, and slept but little during the night, and is occasionally delirious; but his delirium is easily quieted, and his attention fixed for a short time. Pulse 120–130, small, and weak; respiration hurried; has but little constant pain; three bloody dejections during the afternoon and evening. During the day he had three attacks of cramp or spasm, each lasting about half an hour, immediately preceded and associated with a flushing of the face. A sharp, excruciating pain accompanied these, referred to the region of the heart and stomach. The attacks began with a trembling in all the limbs, and a quivering of all the flexor muscles; these gradually and slowly contracted, until it appeared as if the extreme limit of flexion had been reached. The extremities were firmly held in this position, and no force that it was desirable to apply would overcome this fixed rigidity of the muscles. Gradually, however, the rigid muscles would relax, and at the end of half an hour a considerable degree of mobility in the limb was re-established; though, after the first attack, the rigidity did not entirely disappear.

"The patient did not lose consciousness in these attacks, and while they lasted he was constantly turning his head from side to side, his countenance at the same time expressing mingled pain and terror. The rigidity was somewhat more marked upon the left than upon the right side. The breathing became short and quick, a desire for more air was constantly expressed, and the pulse was small and rapid; vomiting did not occur. As

the attacks passed off, a cold perspiration, commencing upon the forehead and gradually extending over the entire body, followed.

"The patient was seen and examined in the evening by Drs. F. I Knight and J. Stedman, and a subcutaneous injection of a quarter of a grain of morphia was given him later.

"3*d*. The patient slept quietly during the night, waking three or four times for a moment, but immediately falling off to sleep; was awake in the morning, and was quite rational. He took nourishment and stimulants, but was extremely weak and prostrated. He died quietly and easily at 9 A. M., being seven and a half days after the beginning of his disease."

The *autopsy* was made, forty-eight hours after death, by Dr. Fitz. There was marked rigor mortis; the subcutaneous tissue of the neck and anterior portions of the trunk emphysematous; a livid patch on the right side of the neck, said to have made its appearance after death.

Head not opened. Anterior mediastinum emphysematous, independent of the conditions produced on removal of the sternum. The valves and cavities of the heart apparently normal, its muscular structure pale, with the microscope found to contain numerous granules, many of which did not disappear on the addition of acetic acid, and were apparently fat and pigment. The left pleural cavity was obliterated by old adhesions, which were emphysematous, and the costal pleura contained numerous bullæ distended with air. On the right side the posterior lateral and inferior portions of the lung were adherent to the thoracic walls by recent fibrinous adhesions, and numerous ecchymoses were present in the thickened, injected, and opaque pleura. In the apex of the right lung a cheesy nodule was found imbedded in dense fibrous tissue, and a similar mass was present in the lower part of the left upper lobe in front. The lungs were œdematous, and posteriorly injected, the lower lobes being moderately collapsed. The pulmonary arteries contained post-mortem clots.

The organs of the thorax and neck were removed in continuity.

In front and to the right, at and below the bifurcation of the trachea, was found a longitudinal rent of the œsophagus two inches in length, extending through all its coats. Its edges were sharply defined, and gave no evidence, microscopically or otherwise, of a pre-existing ulcerative or degenerative process. A communication was thus established between the œsophagus and a sinuous cavity in the posterior mediastinum on the right, which extended between the œsophagus and trachea in all directions, and behind the former to a limited extent. This cavity was of the volume of a small lemon, was crossed by fibrous trabeculæ, and filled with clotted blood. Its walls, neither soft nor pulpy, were of a greenish hue, and the thickened and reddened left pneumogastric nerve could be seen projected behind. The tissues of the posterior mediastinum on the left side were spongy and stained with blood. The pleura covering the cavity mentioned on the right side was adherent to the opposed upper lobe of the lung, the adhesions being recent, discoloured, and offensive. The posterior wall of the trachea, corresponding with the cavity, was of a greenish colour; otherwise there was nothing abnormal here from the epiglottis downwards.

The inner surface of the œsophagus, from the bifurcation of the trachea to the cardiac orifice of the stomach, was of a greenish colour, its epithelial layer in general slightly flocculent, occasionally thickened in patches, and entirely absent over a space an inch in diameter below the rent, the exposed surface being smooth and shining; its walls of normal consistence.

The appearances presented by the stomach were those of chronic catarrhal gastritis, and there was no indication of post-mortem softening. A black grumous material, probably metamorphosed blood, was found in the small and large intestines. The spleen was enlarged and softened—acute splenic tumour; the kidneys gave evidence of cloudy swelling, and the liver was fatty infiltrated.

In brief, it may be stated that a young man, without any pre-existing stricture or ulceration of the œsophagus, becomes choked by a piece of meat. During the violent efforts made to expel the same, a rupture of the air passages takes place, apparently on the left side, and an emphysema arises, which rapidly extends into the neck, but which does not attract attention till just before the meat is expelled. A rupture of the œsophagus also occurs, which becomes evident only after death.

In consideration of the symptoms of this case it is evident that there is nothing in the earlier history of the patient to call attention to disease of the œsophagus or its immediate vicinity. The attacks of gastritis, associated with delirium tremens, are very common events in the life of a drinker, and the existence of a chronic gastric catarrh was rendered certain by the appearance of the mucous membrane of the stomach.

The vomiting of blood is mentioned in connection with these attacks. As a matter of inference it seems more than likely that the blood should have come from the lungs, in different parts of which the results of a previous inflammation were found, and an inflammation of such a character as is very generally associated with hæmoptysis. Even if this blood did not come from the lungs, its having appeared at all is of little or no value in throwing light on the lesion now being considered.

The impaction of a bit of food in the œsophagus, and its remaining there an hour, apparently gave rise to neither nausea nor vomiting. The expulsive efforts did not suggest vomiting; it was a straining, rather, which took place, from the description, such as might occur during defecation or parturition. It is evident that the stomach played but little direct part in this process, at the most serving as a reservoir for air, as an explosive sound attended the ejection of the bolus, without being followed by the escape of food.

It seems further as if the spitting of blood, which took place during the hour of anguish, was rather to be attributed to the straining efforts than to any local changes in the œsophagus. The redness in the face, spoken of, suggests a similar condition of the mucous membranes, and capillary hæmorrhages might readily arise from the bronchial or pharyngeal surfaces. That bloodvessels were ruptured in the air passages at this time is also suggested by the continued mucous expectoration tinged with blood, observed for some days afterwards. The blood in quantity, clotted and fluid, which followed the escape of the meat, was apparently from a different spot, presumably from the ruptured œsophagus.

It is evident from the emphysema that tissues were actually torn during these straining efforts. Although those attending the patient first observed the swelling of the face and neck after the food was expelled, it seems not unlikely that the feeling of constriction from the shirt collar and band may have been an earlier symptom of this condition. It might be thought that this emphysema was due to the escape of gas or air from the stomach through a rent in the œsophagus, made below the meat while it was still impacted. Opposed to this view is the fact, that, during the violent straining and the obstruction of the œsophagus, the emphysema was not noticed, but constantly progressed after the œsophagus was open and the respiration relatively quiet. It seems most likely, therefore, that a rupture of the air passages was the cause of the emphysema at the outset, as it evidently was later, also that this rupture took place on the left side independently of the tear in the œsophagus, from the fact that the sub-pleural tissues and the pleural adhesions on this side alone were infiltrated with air, and there was an absence here of evidences of recent pleurisy. An additional argument might be derived from the external swelling being first noticed on the left side of the neck. It appears that a double rupture must have occurred within the lung in the first place to permit the air to pass upwards and make its way beneath the costal pleura, and secondly through the pleura that the adhesions might become emphysematous.

The time when the rupture of the gullet took place is not so apparent. The sole sign of its occurrence is the hemorrhage; the manner of the escape of the food is also somewhat indicative. Were the rupture present in its totality before the food was expelled, the emphysema should have occurred earlier from the stomach, and a large rent in the pleura would be expected. It might even be expected that food should have been found in the pleural cavity as a result of the extreme muscular force employed. It would also have been probable that the obstructing piece itself would have been forced through the rent, and thus hemorrhage, even vomiting, have preceded the actual escape of the fragment, and then the decided explosion could scarcely have taken place.

It may have been that the tearing of the œsophageal wall had begun before the expulsion of the food, as clotted blood followed it, but that the rupture as a whole occurred at the time of the expulsion seems most probable, from the negative evidence already presented.

The collapse following the escape of the food is in part to be referred to the preceding exhaustion, mental and physical, and in part to the hemorrhage, which continued till the time of death, as evinced by the bloody stools during life, the presence of metamorphosed blood in the intestines, and of clotted blood in the mediastinal cavity. That no large bloodvessels were ruptured, seems indicated by the small amount of blood raised immediately after the removal of the meat, and from the fact that the contents of the stomach vomited an hour later contained little or no blood.

It is a matter of considerable interest and of decided value that the only pain complained of at the outset was in the left chest after the removal of the obstruction, and which was very likely of a similar character to the tenderness on pressure over the clavicle, due to the emphysema. The sharp migratory pains on the right side, noticed on the following day, were more likely to have been occasioned by the beginning of the recent pleurisy eventually demonstrated.

Of the subsequent symptoms occurring in this case, there are scarcely any which may be considered as calling direct, exclusive attention to the œsophagus. There is neither severe localized pain nor difficulty in swallowing. Fever, diminishing nausea, and irritability of the stomach, with sensitiveness to pressure in the epigastrium, and complaint of occasional pain in the stomach, are noted. Blood makes its appearance in the vomit, the alvine dejections, and in the expectoration. The spasms of the flexor muscles towards the end of life are apparently of a tetanic character. The simultaneous disturbance of respiration suggests a similar condition of the respiratory muscles. Without considering this group of symptoms at length, it may be stated that the close proximity of the pneumogastric and sympathetic nerves to the ascertained lesion, afford opportunity for the transfer of an existing peripheral irritation, and the former nerve trunk was seen to give evidence of pathological changes in the form of enlargement and injection deserving the name of neuritis.

It has already been stated that but few cases of this affection have been recorded, and that most of these are to be considered as doubtful in their nature. Some of the references have been copied by one author from another, apparently without any effort being made to examine the record of the original observation. In the present inquiry the original source of information has always been sought for, and in most cases found. The success of this effort is largely due to the courtesy of those in charge of that extensive collection of medical works, the Library of the Surgeon-General's Office at Washington, to whom my thanks are most gratefully rendered.

The oldest case mentioned, that which, with but few exceptions, among writers, is quoted as the type of the class, lacks so much that is desired, that the diagnosis is not only not proven, but may well be regarded as incorrect. This assertion necessarily premises that the following extracts contain the essential features of the original account of Boerhaave.[1] The case is referred to somewhat quaintly by Van Swieten,[2] as follows:—

"We have a surprising observation given us by the celebrated Boerhaave, which is, perhaps, the only one published, namely, the illustrious Baron Was-

[1] Atrocis nec descripti prima morbi historia. Lugd. Batav., 1724.

[2] The Commentaries upon the Aphorisms of Dr. Herman Boerhaave. By Gerard Van Swieten, M.D. 2d edition. London, 1765. Vol. ii. p. 112.

senaer, Lord High Admiral to the Republick, after intense straining in vomiting, broke asunder the tube of the œsophagus, near the diaphragm, so that, after the most excruciating pains, the aliments which he swallowed passed, together with the air, into the cavity of the thorax, and he expired in twenty-four hours."

Lieutaud[1] records the same case, but somewhat more in detail.

From him it appears that the Admiral, who was more than fifty years old, suffered an annoyance at the pit of the stomach three days after feasting sumptuously. During the efforts to obtain relief by vomiting, the sudden pain, "as from some rupture or tearing," occurred. "During the progress of the affection, he was constantly tortured with extreme pains. In the mean time the increased suffering threatened syncope; there was neither fever, cough, nor difficult breathing. The vehemence of the pains prevented any motion of the body, and there was scarcely any remission from their great severity. They seemed to be seated primarily within the chest near the diaphragm, thence extended to the back and throughout the entire chest. Finally the strength gave way, and he died suffocated, the horrid symptoms continuing. Nothing noteworthy was found in the abdomen; a large amount of gas escaped from the first incision into the pleural cavity. The lungs and heart were unaffected. A marked and unusual smell came from the chest, as if proceeding from some putrid fluid in which the posterior parts of both lungs were bathed; this fluid, amounting to six pounds, did not differ in the least from the contents of the stomach. The body having been thoroughly cleansed, there was found a transverse rupture through the œsophagus near the diaphragm."

A transverse rupture near the stomach, permitting the escape of fluid into both pleural cavities, and the association with evident decomposition, are strongly suggestive of cadaveric softening. Death within twenty-four hours after the sudden intense pain and subsequent torture, without cough, dyspnœa, or evidences of pleurisy, is not indicative of a pre-existing rupture of the œsophagus, which should permit the contents of the stomach to enter the pleural cavities. Cadaveric softening might have taken place in connection with the rupture of the gullet, but evidence of the antemortem nature of the latter is wanting. The possibility of the existence of angina pectoris, perforating ulcer of the duodenum, even of a dissecting aneurism, might be considered, and neither the symptoms nor the postmortem examination permit a differential diagnosis to be made.

Ziesner[2] is credited by some with a case of this affection, and he describes, in 1732, "a rare disease of the œsophagus." The case is apparently one of puerperal fever, with purulent inflammation of the kidneys, ovary, and liver. An abscess of the size of a butternut had broken into the œsophagus. The fifth and sixth vertebræ, near which the abscess was situated, were eroded.

More than fifty years after the occurrence of Boerhaave's case, there is published by Mr. John Dryden,[3] Surgeon in Jamaica, "An account of a Rupture of the Œsophagus from the Action of Vomiting."

A strong, healthy man, on the morning after a debauch, on account of nausea drank plentifully of warm water to induce vomiting. He always guarded against emetics, and strained hard during their use, feeling sore and weak for some time after.

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[1] Historia Anatomico-Medica. Tomus secundus. p. 311. Parisiis, 1767.

[2] Haller's Disputationes ad Morborum, etc. Lausannæ, 1760. Vol. vii. p. 629.

[3] Medical Commentaries. Edinburgh, 1788, p. 308.

During his straining he felt something give way internally, with the sensation as if liquid had been injected into the thoracic cavity. A slight amount of blood was raised, and acute pain was felt in the region of the stomach and abdomen. The vomiting then ceased, and was followed by thirst, great heat in the stomach and thorax, constipation, and restlessness. Emphysema of the neck soon appeared. In the afternoon the pain was most severe on the left side. The breathing then became laborious; he was unable to change his position without feeling that his lungs were compressed and the fear of suffocation. Death occurred at 10 P.M. On opening the thorax air escaped, and a gallon of fluid was removed from the left side, nearly two quarts from the right. There was a longitudinal rent in the œsophagus above the diaphragm large enough to admit two fingers, and the contents of the stomach had entered the thorax and compressed the lungs.

This case is somewhat peculiar, and by no means satisfactory. The sudden, tearing pain, as in Boerhaave's patient, the sensation of injected fluid and slight hemorrhage, seem suggestive. The referring the pain to the abdominal region scarcely comports with the supposed lesion. The emphysema is more than likely to have been the result of a laceration of the air passages, and it may have been this which caused the sudden sensations at the outset. The same suspicion of post-mortem softening arises here; quantities of fluid in both pleural cavities too great to have been the result of pleuritic effusion within ten hours, and also stated to have come from the stomach. It is further to be considered that the patient lived in a hot climate, where the elevated temperature would favour a post-mortem softening of the œsophagus, and the character of the rent is not sufficiently described to determine its nature.

Reil's name is mentioned in connection with this subject, but in the work[1] referred to no case was found bearing upon the point. Kade[2] states, however, that this author had spoken of the conditions in describing the disease of a certain Goldhagen. Kade's[3] case (probably the same) of rupture of the œsophagus is described in a thesis presented by him for the degree of Doctor of Medicine.

He reports the case as one of gangrene of the œsophagus:—

The patient fell sick with 'malignant nervous fever,' which caused gangrene of the œsophagus by metastasis. Throughout the entire course of the disease there was no complaint of pain in swallowing. On the 11th day of the disease, frequent drowsiness and weakness supervened, and the patient died after a few days.

The œsophagus, from the diaphragm to the pulmonary veins, was in a "gangrenous" condition, destroyed throughout its entire circumference, with but a few fibrous connections here and there; so that food and drink entered the thoracic cavity. From the admirable drawing accompanying the thesis, as well as from the text, it is evident that the gangrene was a simple post-mortem softening of the œsophagus.

Sedillot has been supposed to have contributed to the knowledge of this

[1] Memorabilium Clinicorum. Halae, 1790, vol i., fasc. i.

[2] De Morbis Ventriculi. Halae, 1798, p. 17.

[3] Op. cit., p. 16.

subject, because he published[1] a case of stricture of the œsophagus, followed by rupture of the canal and a consequent gangrenous abscess. The introduction of a probang seems to have played an important part in the production of the result.

The next record of a case of rupture of the œsophagus in consequence of vomiting is that of Guersent.[2]

A girl of seven years, whose previous health had been good, after a diarrhœa of several days' duration, was seized with vomiting a short time after dinner. During the subsequent two days there was nocturnal fever, mild delirium, thirst, drowsiness, and involuntary fetid yellow dejections. The drowsiness then continued, and nausea was complained of. Suddenly a violent convulsion occurred, during which the tongue was protruded, and the skin became a dark-red colour. Great feebleness followed. Guersent saw her some hours later, when her face was a violet colour, the skin being hot and dry, the pupils dilated, and the jaws set; convulsive movements of the lips were also noticed. The pulse was full and frequent, the respiration natural, although there was an occasional cough. The application of leeches was followed by a diminution of the drowsiness, though the other symptoms continued. An emetic was administered, and the child made vain efforts to vomit. The pulse now fell rapidly, the extremities became cold, the respiration disturbed, and swallowing was painful. Partial convulsions occurred during the night; towards morning the skin became of a violet colour, the pulse failed, and the patient died.

At the autopsy the cerebral vessels were found to be engorged; a rent two centimetres long was found in the right pleura some five centimetres above the diaphragm. Pressure upon the stomach caused the escape of a fluid through this rent into the right pleural cavity, which contained a brown fluid, in which were green flocculi. The edges of the rent in the œsophagus gave no evidence of suppuration or of preceding alteration, and the stomach and œsophagus were healthy, without any trace of inflammation.

It is evident that an acute febrile disease was present, in which dark-red discolouration of the skin was prominent. Nausea, vomiting, and diarrhœa had existed for two days before the convulsions began. Painful swallowing was noticed only just before death. The clinical history suggests rather a case of scarlet fever than one of rupture of the œsophagus, and the condition found after death is much more likely to have been the result of cadaveric softening than of a rupture.

Guersent mentions the occurrence of two analogous cases—that of Boerhaave already quoted, and one "in the second volume of the *Journal of Desault* will be printed in detail with the conclusions of the author in the early volumes of the Memoir of the Society."

The cases of Boerhaave and Dryden are alluded to by Monro,[3] who states that Dr. Carmichael Smyth had communicated to him a similar case. He also speaks of having seen a preparation of the œsophagus of a child in which was a considerable longitudinal rupture. Such statements of course can have no weight where any sort of criticism is attempted.

[1] Recueil Periodique de la Société de Médecine de Paris, 1799, t. vii. p. 194.

[2] Bulletin de la Faculté de Médecine de Paris, 1812, t. i. p. 73.

[3] The Morbid Anatomy of the Human Gullet, Stomach, and Intestines. Edinburgh, 1811, p. 311.

Bouillaud[1] reports a case as one of rupture of the œsophagus, where the diagnosis is evidently so incorrect that a summary of the main points is alone desirable.

A man, 20 years of age, had a purulent discharge from the right ear since he was eight years old. There was some gastric disturbance for six weeks previous to his entrance into the hospital, and he had been confined to his bed four days immediately preceding his admission. His chief symptoms were chills, fever, headache, delirium at night, and repeated vomiting. There followed increasing weakness, intermitting right hemiplegia, dilated pupils, incoherent speech, alternating drowsiness and excitement, involuntary dejections, collapse and death ten days after his arrival at the hospital.

The autopsy showed caries of the middle ear, injected cerebral membranes, and much opaque fluid in the lateral ventricles, with softened brain substance. Four perforations were found in the splenic region of the stomach, a wounded perforation of the œsophagus a little above the cardia, also a rent an inch and a half long, through which part of the contents of the stomach entered the pleural cavity, which also contained gas. Gas and fluid were found too in the abdomen.

Under the title "Observations on the Digestive Solution of the Œsophagus," King[2] publishes the report of a case by Mr. Comley, with the results of his examination of the stomach. He expressed himself unable to say, "if there be a rupture, where the post-mortem solution ends, and where laceration begins. I think, the probabilities considered, there was no rupture." Habershon[3] offers the same case as warranting the belief that rupture of the œsophagus may take place during life. As this case was not originally presented as one of rupture, and as, after carefully examining the original record, there appears to be no good reason for doubting Mr. King's opinion, it seems unnecessary to call any further attention to the report. This paper, and another by him in the preceding volume of the Reports, deserve special mention for calling attention to the frequency of cadaveric softening of the œsophagus, and its relation to the similar condition of the stomach. Since its date, much more care seems to have been exercised in the observation of suspected cases, and an opinion is not arrived at without very cogent reasons.

A paper by Vigla[4] on perforations of the œsophagus may here be alluded to as containing a very extensive series of cases, original and collected from various sources, with the conclusions at which he arrived. Among these there are none which can properly be included under rupture from muscular action, but all are perforations associated with various pathological conditions, and from foreign bodies, or are cases of post-mortem softening.

[1] Archives Générales de Médecine, 1823, t. i. p. 531.

[2] Guy's Hospital Reports, 1843, 2d series, vol. i. p. 113.

[3] Pathological and Practical Observations on Diseases of the Alimentary Canal, etc., Am. Ed., Philadelphia, 1859, p. 52.

[4] Archives Générales de Médecine, 1846, 4th series, t. xii. p. 15.

The following statement by Oppolzer[1] is of decided interest, but of slight value from its brevity.

"I have seen only one case of rupture of the healthy œsophagus. The patient had strained herself in ironing, and died of hemorrhage into the mediastinum. . . . . The symptoms are uncertain, but point in general to a severe affection. A violent pain suddenly occurs on vomiting, blood is vomited, there is anxiety and a sense of oppression from the entrance of food and drink into the mediastinum. The disease may be suspected when suddenly, during vomiting, a violent pain arises in the course of the œsophagus, vomiting can no longer take place, and when earlier disturbances were present."

This case is referred to later[2] in about the same terms. The symptoms and means of diagnosis as recorded by Oppolzer are mentioned as possibly being the result of his own observation in the case referred to. They carry less weight, however, as Boerhaave's case is accepted in the same article.

This brief record cannot, therefore, be considered as of any value for purposes of generalization, and if its statements conflict with those of more fully recorded and better authenticated cases, they must necessarily be set aside.

Meyer[3] publishes a case which he regards as one of rupture of the œsophagus from violent efforts in vomiting, there being no evidence of preceding ulceration, abscess, or gangrene. Not having been able to obtain the original account of this case, the following statement[4] is inserted, which is "as complete as possible."

"A shoemaker, thirty-eight years of age, a drinker, on account of having taken lye when a child, had suffered since then from difficulty in swallowing; the food would stop near the pit of the stomach, and violent efforts were required for its dislodgment. Of late this difficulty had increased. February (?) 1, 1858, while at dinner, a piece of sausage stuck in the usual place. Violent efforts were made to remove the food, during which his anxiety became so extreme that he ran outdoors. Repeated attempts at vomiting were made; about a cupful of bright red blood followed, but the sausage could not be raised. Anxiety, a feeling of oppression, and epigastric pain became so extreme, that the patient returned to his house. About an hour after the beginning of the attack, a swelling appeared in the right side of the face. A physician, thinking the food to be still impacted, gave an emetic, and introduced a probang, without any benefit, for the patient did not vomit, and his difficulties increased.

"He was received into the hospital on the 2d of July, at noon. His condition then was as follows: He could be put to bed only in the upright position, with the body bent forwards. The face was pale, slightly cyanotic. There was emphysema of the right side of the face, of the neck, of the entire front of the chest, the sternum excepted. There was a clear resonance on percussion of the chest, and an abnormally diminished resistance. Behind, on the right, there was diminished resonance from the ninth rib downwards, above this point it was normal; behind, on the left, percussion was impossible, on account of the emphysema. There was good vesicular respiration everywhere, except behind at the base, where the breathing was indistinct. Local fremitus indistinct below

[1] Wiener Medizinische Wochenschrift, 1851, p. 65.

[2] Oppolzer's Vorlesungen über specielle Pathologie und Therapie, von Stoffela. Erlangen, 1872, vol. ii. p. 150.

[3] Medicinische Vereinszeitung in Preussen, 1858, Nos. 39, 40, 41.

[4] Canstatt's Jahresbericht, 1858, vol. iii. p. 334.

and behind. Respiration 40. Impulse of the heart feeble, but in the usual place. Sounds distinct. Pulse small, soft, 142. The patient complains of a very violent squeezing pain, which proceeds from the base of the ensiform cartilage to a spot one-half an inch below its point, thence extends backwards to the spine. This pain is increased by attempts to sit upright, or to bend backwards. The spine is not sensitive to pressure. *Diagnosis:* Rupture of the œsophagus; moderate pleuritic effusion in the right pleural cavity, probably in the left likewise. Emphysema of the skin dependent upon the rupture of the œsophagus.

"Sinapisms and ice to the chest, also ice internally gave no relief; the emphysema increased, the pains in the chest and along the spine became more severe; fluids could be swallowed, but only in small quantities, on account of the extreme desire for air. Swallowing produced a feeling of compression near the cardia. At 2 P. M. on the 3d the patient died, the disease having lasted fifty hours.

"*Autopsy.*—The œsophagus free throughout almost its entire extent. A gaping, ulcerated surface one and one-fourth inch long and three-eighths of an inch wide was observed three inches above the cardia, in the anterior wall of the œsophagus; the edges were tolerably smooth, in places sharply defined as if the ulcer had been cut out. The mucous membrane more extensively destroyed than the muscular coat, from which it could be easily raised, and its edges were not thickened.

"The submucous tissue in the vicinity of the ulcer was of ordinary consistence, and not specially thickened. The muscular coat was distinct to the very edge of the ulcer, in the alcoholic preparations showing the same colour and configuration as in the other healthy portions, and the microscopical examination, though not showing distinct muscular elements, yet establishes the identity with the healthy portions. The coats in the immediate vicinity of the ulcer are not softened. The rest of the œsophagus is somewhat widened; above the cardia it is somewhat narrow, but without distinct cicatricial tissue, the muscle here being hypertrophied.

"The mucous membrane below the great gaping wound presents numerous small, linear, yellow streaks from one-half a line to two lines long, which are parallel to the long axis of the gullet. With the microscope these are found to be composed of an amorphous substance, without epithelium. The subjacent mucous membrane is normal.

"A large gangrenous cavity extended forwards from the perforation into the posterior mediastinum, separating the œsophagus from the cardia upwards for five and one-half inches from its surroundings; it contained dead tissue, and numerous particles of food, and its wall gave no evidence of a chronic thickening. There was exudation, etc., in both pleural cavities. The stomach and intestines were distended with gas, etc."

A dissertation upon rupture of the œsophagus is published by Grammatzki,[1] and is extracted by Gerhardt.[2] The subject is illustrated by a case occurring in Leyden's clinic, regarded as one of spontaneous rupture in a previously healthy person.

"An English machinist, John Mudd, thirty-five years old, six weeks ago suffered for some time from gastric disturbance, from which he recovered. June 15, 1867, after carousing the night before, he was seized at 7 A. M. with vomiting, mixed with blood, violent pains in the stomach, coldness of the extremities, and a collapsed appearance—with repeated vomiting again after nine o'clock. After this second attack of vomiting, which was also bloody, the neck began to swell. The patient ascended the steps of the hospital without assistance, and spent

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[1] Ueber die Rupturen der Speiseröhre. Königsberg, 1867.

[2] Jahresbericht der gesammten Medicin. Virchow und Hirsch, 1867, vol. ii. p. 144.

the rest of the time bent forwards in an easy chair, till his death at 6.30 in the evening. His face expressed anxiety and pain, there were frequent groaning, emphysema of the cheeks, eyelids, neck, and front of the chest, somewhat more marked on the right, but the arms and sides were free from it. Violent pain and increased dyspnœa resulted from swallowing. Percussion and auscultation gave no special information. In the afternoon decided collapse supervened, cold sweats, pulseless extremities, a bending back of the head, increasing cyanosis, and asphyxia. At the autopsy there was found a double pneumothorax, and in each pleural cavity were six to eight ounces of a reddish fluid, in which were solid particles and fat drops. The tissues of the anterior and posterior mediastina were filled with air. Above the cardia was a cavity of the size of a walnut formed from a greenish-black, frangible tissue, which communicated with the pleural cavity by a large hole, through the pleura, of the size of a four-groschen-piece. On the other side there was a wound, through the wall of the œsophagus, five centimetres long. This was longitudinal, like a tear, with sharp edges, and encroached upon the stomach below. A similar wound, extending only to the submucous tissue, was found upon the anterior wall of the cardia, for the most part within the cavity of the stomach. These wounds of the œsophagus were attributed by Leyden to some foreign body which had been swallowed, and were considered to be explanatory of the illness six weeks before. It was left undecided whether the vomiting on the morning of the last illness was the cause of the perforation or a symptom of it."

Strictly speaking, this can hardly be regarded as a pure case of spontaneous rupture of the œsophagus from muscular action. Leyden's opinion that a rupture had occurred, necessarily carries great weight, though the description of the opening into the pleural cavity suggests cadaveric softening rather than rupture. If the vomiting and the rupture occurred simultaneously, as is suggested, and the contents of the stomach had then entered the pleural cavity or cavities, pneumothorax should have made itself manifest before the autopsy took place; but no special information was obtained by auscultation and percussion. Even supposing it to be one of sudden rupture, the assumed previous injury to the œsophagus from a foreign body would remove it from the more spontaneous forms in healthy gullets. A further possibility may be entertained that this was a case of combined rupture and post-mortem softening. A microscopical examination of the edges of the wound might have been of considerable service in eliminating post-mortem agencies, though the presence of the contents of the stomach in the pleural cavities gives opportunity for the dissolving material to act upon the edges of an actual rupture.

Finally Charles[1] reports a case of "Rupture of the Œsophagus; with Remarks thereon."

"The patient was a man, 35 years of age, who from infancy had been occasionally distressed with difficulty of swallowing. He was of intemperate habits, and had been drinking to excess for a few days before his death, and it was suspected that some of the whiskey had been medicated. At 8 P. M., after a light dinner and while exercising a horse, he felt something give way inside of him during attempts to vomit. He reached the house with difficulty, and fell on the floor in great agony. The pain, first felt in the region of the left kidney, ascended towards the stomach and back of the chest, became more severe, and there was much retching. Dyspnœa and thirst ensued, the patient became

[1] Dublin Quarterly Journal of Medical Science, 1870, vol. l. p. 311.

delirious, the pulse, previously strong, suddenly failed, and death took place seven and a half hours after the vomiting first appeared. The autopsy was made twenty-nine hours after death, the weather being tolerably warm, and on turning the body dark fluid escaped from the mouth. At the left side of the œsophagus, near the posterior wall, a longitudinal rent was found, an inch and a half in length, extending from immediately below the cardiac orifice of the stomach upwards. This led into a space in the posterior mediastinum which contained black grumous matter like that in the stomach. The space communicated with the left pleural cavity by a round opening, through which the contents of the stomach could be pressed into the left pleural cavity. The left pleura was blackened along the lower two-thirds of the posterior mediastinum, and the left pleural cavity contained two quarts of dark offensive fluid containing starch and oil. In the right pleural cavity there was found a quart of fluid appearing like bloody serum. The mucous membrane in the cardiac end of the stomach was very soft and of a dark hue."

That post-mortem softening was present in this case is evident, and is admitted by Dr. Charles. He thinks, however, that a rupture of the œsophagus preceded death. The opinion seems to be based mainly upon the sensation of internal laceration, the appearance of the rent, a theory of its causation based upon an analogy with doubtful cases of laceration of the stomach, and the knowledge of previously recorded cases, among which Dryden's occupies a prominent place from its obvious resemblance.

A subjective sensation becomes of real value only when its cause is made clear, and this is plainly in dispute. The intense pain complained of was not referred at first to the œsophagus, where the tearing is assumed to have taken place, but to the left kidney. If the injury had occurred during the early vomiting, a sufficient time intervened to permit evidence of inflammation of the pleura covering the mediastinal cavity. The appearances of the edges of the wound would evidently depend largely upon the length of time they were in contact with the gastric fluids, as well as on the degree of concentration of the corroding agents. Hemorrhages into the mediastinum, and the vomiting or raising of fresh blood, both likely to have taken place, were not observed. The nature of the laceration of the stomach referred to, may be regarded as equally, if not more, in doubt than the condition in question. If Dryden's case can be considered in dispute, as well as some of the others referred to, Dr. Charles's case must be considered as still in doubt.

The disturbing element in most of these cases is evidently the softening of the stomach and œsophagus.

Previous to the year 1786, when Hunter published his observations on the self-digestion of the stomach, the possibility of a perforation of this organ otherwise than as a result of pathological conditions was not thought of. It is consequently very evident why Boerhaave and Dryden should not have considered this feature differentially. The latter ought to have done so; the fact that he did not suggests that Hunter's observations were not familiar to him. Even after these had been published, there were many authorities, French and German particularly, who disputed his views and spoke of softening of the stomach as a disease. The value of King's

papers, already referred to, was very direct, therefore, in calling renewed attention to Hunter's work, and in showing that the œsophagus was exposed to the same alteration.

The most important contribution to this subject since Hunter's time is unquestionably that of Elsässer (1846), who showed experimentally and otherwise that an acid fermentation of the contents of the stomach was the main element in producing the softening and perforation. Among recent authorities who advocate an ante-mortem softening of the stomach and œsophagus is Hoffmann.[1] He maintains as of this nature the brown form of gastro-malacia, that which is observed among adults, though met with in children also, and regarded by most observers as not differing from the gelatinous form except in the presence of injected bloodvessels.

He considers that a number of cases observed by him elevate this opinion to a certainty. He further maintains that this form of softening, usually if not always, is the result of a hemorrhagic infarction, the presence of acid gastric fluids causing a maceration of the altered parts. As the cases reported are regarded as including a pre-existing localized pathological process as a cause for the rupture, their consideration does not fall within the province of this paper.

The number of indisputable cases of rupture of the œsophagus under the conditions mentioned, may be considered as two, possibly three: those of Meyer and Allen, and those of Grammatzki. The similarity of the symptoms in the last case to those in the others is unmistakable, and their occurrence in a future one would point very strongly to the lesion in question. At the same time the case is not sufficiently fully reported in the abstract, nor is it sufficiently freed from the suspicion of post-mortem changes, to permit its use in the further consideration of this subject.

As the cases of Meyer and Allen are, therefore, the only ones (Oppolzer's being merely an allusion) from which a knowledge of this class of spontaneous ruptures could be obtained, it follows that the statements to be found in the text-books and elsewhere, previous to 1858, are to be considered as essentially theoretical. It may be said that they are based upon errors of observation, insufficient testimony, and superficial generalizations. That such a statement can be made indicates merely that in some respects the opportunities for criticism are greater now than was the case twenty years ago and earlier. It may also be regarded as premature that an attempt should here be made to present the history of an affection which has offered so few opportunities for its study. This article is intended mainly as a means of assistance for those who may hereafter acquire an interest in the subject, and who may find it difficult to obtain some of the necessary data.

[1] Virchow's Archives, 1868, xliv. p. 352, and 1869, xlvi. p. 124.

Rupture of the healthy œsophagus in a person free from disease may take place as a rare occurrence. Such ruptures are quite independent of and distinct from the lacerations and other traumatic injuries produced by the contact of unyielding foreign bodies. The rupture takes place between the bifurcation of the trachea and the diaphragm, in the anterior or lateral walls of the œsophagus, and corresponds in direction with the long axis of this tube. Such rents lie wholly within the thoracic cavity, are from one to two inches in length, and are distant from, rather than near to, the cardiac orifice of the stomach. Though it is not impossible that the tearing of the tissues may extend through the pleuræ, one or both, such an event is very unlikely and of doubtful occurrence. There are two factors essential: the impaction of a foreign body in the œsophagus, and the exercise of great muscular force in the attempts to remove it. There is no good reason for considering that the act of vomiting can in any way produce this result, nor is it essential that the foreign body should remain in contact with the œsophageal wall long enough to give rise to inflammation from pressure. The fact of muscular action alone being sufficient as the active agent is of considerable value from a medico-legal point of view, in those cases where the introduction of a probang or a bougie may be asserted as the cause of the rupture.

Those persons in whom this lesion has been met with have been drinkers, and have suffered from various disturbances of digestion. There is no reason to suppose, however, either that the excessive use of alcohol as such, or the digestive disturbances have been special predisposing causes of any marked importance.

Soon after the impaction of the foreign body, as a piece of meat or a bit of sausage, and the unsuccessful attempts at its removal, intense anxiety becomes evident on the part of the patient. Violent straining efforts are made to expel the obstructing body. The chest is fully inflated, and powerful efforts are made by the respiratory muscles. More or less blood is ejected during this period, either mixed with saliva and mucus, or raised in considerable quantities as a bright red fluid. In the course of an hour usually an emphysema makes its appearance in the neck and face, which probably comes from a rupture of the air passages during the violent straining. The hæmoptysis is probably from a similar source. The impacted substance is either eventually expelled or makes its way downwards; if expelled, it may be immediately followed by a decided explosive sound, though not necessarily by the contents of the stomach. The regurgitation of fluid and clotted blood, unmixed with air or food, after the evident displacement of the foreign body, gives evidence of a laceration of the œsophageal wall, though the extent of the same cannot be determined.

Pain is not a very prominent early symptom. When present it is referred

to the region of the stomach, and later to the emphysematous parts. It has not been found to be of a tearing character, nor is suddenness one of its features. A varying degree of epigastric pain and tenderness continues during the subsequent course of this affection, extending from the ensiform cartilage to the spine, and increased on bending backwards. Pains of another character, sharp and stabbing, supervene where the pleura becomes inflamed, as it may, from the extension of the inflammation from the mediastinum, either by continuity of tissue or as a result of laceration.

Nausea and vomiting are not prominent features, though blood is occasionally vomited, either pure or mixed with the contents of the stomach. Liquids may be swallowed without pain, though a feeling of constriction is at times excited by their passage downwards. The patient falls into a condition of great exhaustion after the violent straining, from which he rallies in the course of twenty-four hours, when fever is evident. The emphysema advances, the patient has difficulty in breathing, there may be orthopnœa even, also slight cyanosis, and death may occur within fifty hours, or may be postponed for seven or eight days. When the disease assumes a protracted course, it is essentially a gangrene of the mediastinum combined with gangrenous pleurisy; there are continued fever, great prostration, mild delirium, pains in the stomach and chest, and bloody stools after a time. Tetanic convulsions may occur if the inflammation in the mediastinum involves the nerves along the spine.

Many of the symptoms occurring in these cases are apparently those resulting from the emphysema. At the outset there is little to call direct attention to the œsophagus except the impaction of the food and the eventual hemorrhage, and nothing to determine absolutely the fact of a complete rupture at the time of its occurrence. Later the symptoms are essentially those of a septicæmia. The diagnosis is likely to be attended with considerable difficulty, and death is the result.

Hamburger says :—[1]

"We must admit that up to the present the diagnosis is first made upon the corpse, and often contrary to all expectation, "to which it can be added that even then the diagnosis may be attended with very great difficulties." We believe, however, that, by auscultation of the œsophagus during the act of swallowing, the most valuable assistance may be obtained. The place where the perforation has occurred may be exactly designated when the difficulty in swallowing is relieved, and the fluids swallowed reach a certain point only, beyond which they cannot be recognized. Sometimes a slight blowing sound is heard at this point on swallowing. This method is applicable only to those cases where the rent is sufficiently large to permit the liquids to pass through. If the opening is too small for this, there is then no communication, and the rupture runs a latent course."

This suggestion is of value in so far as it offers a new application of the auscultatory method, and it has apparently proven satisfactory in

[1] Klinik der Œsophagus Krankheiten. Erlangen, 1871, p. 189.

certain cases of perforation. The objection raised by Oppolzer, that the usual condition of the patient is not likely to permit the employment of this means of diagnosis, is hardly applicable to cases of the character here referred to. He also suggests, as a precaution, that only small quantities of fluid should be swallowed. The patient, however, is either inclined to take fluid in small quantities, or else suffers no apparent inconvenience from larger amounts.

Boston, Nov. 1876.